THE VALUE OF THE SACHS-GEORGI REACTION IN THE SEROLOGICAL DIAGNOSIS OF SYPHILIS

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In order to determine to what extent the Sachs-Georgi could be relied upon to replace the Wassermann reaction in this country (Palestine), I commenced to perform a parallel series of tests in the latter part of 1921. It was by no means difficult to secure suitable material, inasmuch as it was possible to collect the sera of a large number of untreated cases which gave true clinical manifestations of syphilis in one or other of its various stages and forms. It was not so easy, however, to gather together sera from cases undergoing treatment, nor to follow up the effect of such treatment on the reactions.

Doubtless the disappearance of the then existing lesions led those affected into the belief that they were cured, and this deduction of ' out of sight, out of mind ' is strengthened by the fact that only comparatively few names appear on the register more than once.

The conclusions arrived at, both from the performance of the ordinary tests and from certain experiments carried out bearing on the subject, are of interest, if, in one or two particulars, somewhat puzzling.

I shall in this paper detail:—

(*a*) the methods employed—including the technique of the Sachs-Georgi reaction as carried out during the whole series; (which technique I have found by experience easiest and most suitable);

(*b*) the actual results of the two reactions;

(*c*) the relative percentage of agreement;

(*d*) certain fallacies of the Sachs-Georgi reaction—certain experiments made with a view to explain the cause of several, and certain theoretical observations; and finally,

(*e*) the conclusions and inferences drawn.

(A) METHODS EMPLOYED

For the performance of the Wassermann reaction, the Boas modification of the original has always been employed; the results of this technique have been so uniformly dependable that no other method is permitted in these laboratories. The antigen and haemolytic serum are both prepared by Burroughs, Wellcome & Co., and are forwarded every three months.

The technique of the Sachs-Georgi reaction is simplicity itself, and will be briefly outlined here.

(*a*) *Antigen.* This is supplied quarterly by Burroughs, Wellcome & Co., and although, in 1921, I experimented with various antigens, I found that prepared by the above firm so reliable that it was adopted in preference to the others.

A dilution of 1 in 20 is required.

1 c.c. antigen is pipetted into the ordinary 1 inch by 6 inches test-tube. To this is added 1 c.c. normal saline freshly prepared—the saline being allowed to run slowly down the side of the test-tube held in the sloping position.

The tube is agitated gently during the process of admixture. 18 c.c. normal saline are now to be added. The test-tube is held vertical and a pipette containing the 18 c.c. held with its point midway over the upper end of the tube. By gentle pressure on the indiarubber teat, the saline is allowed to fall drop by drop the height of the test-tube into the mixture; during the whole time this is being effected, the tube is gently shaken from side to side. The tube now containing 20 c.c. of 1 in 20 dilution is inverted slowly against the palm of the hand several times. The resultant antigen, ready for use, is a shimmering, somewhat opaque fluid with just a milky tint, giving the appearance of watered silk.

(*b*) *Patient's serum.* The serum is inactivated as in the Wassermann reaction, for half an hour at 56° C. When sera have to be sent to the laboratory from a distance, the medical officers are issued with instructions that blood must be taken with all aseptic precautions, and that the serum should be allowed to separate out in a sterile test-tube (preferably kept over night in the sloping position) and transferred to sterile bottles which are then carefully stoppered and sealed. In this way not only is haemolysis prevented

but also is obviated one of the chief causes of failure (to be detailed below) of the Sachs-Georgi reaction and discrepancy between this reaction and the Wassermann.

(*c*) *Method of setting up the reaction.* Four Wassermann tubes are used for each case, and dilutions of patient's serum made, 1 in 5, 1 in 10, 1 in 20, and 1 in 40, with normal saline freshly prepared.

Into tube 1 is placed 1·6 c.c. and into tubes 2, 3, and 4, 1 c.c. of normal saline.

To tube 1 is added 0·4 c.c. patient's serum and the contents of the tube are thoroughly mixed with a pipette. One-half the contents of tube 1 is transferred to tube 2 and thorough mixture made again.

To tube 3, one-half the contents of tube 2 is added, and again, after mixture, one-half the contents of tube 3 is transferred to tube 4. After suitable mixing, one-half of the tube 4 contents is now discarded.

Tube 1 now contains 1 c.c. of 1 in 5 dilution of patient's serum.
Tube 2 ,, ,, 1 c.c. of 1 in 10 ,, ,, ,,
Tube 3 ,, ,, 1 c.c. of 1 in 20 ,, ,, ,,
Tube 4 ,, ,, 1 c.c. of 1 in 40 ,, ,, ,,

To tubes 1, 2, 3, and 4 is added 0·5 c.c. of the already prepared 1 in 20 dilution of antigen, and the contents of all tubes are thoroughly mixed by inverting the tubes between the thumb and different fingers several times.

The tubes are now placed in an ordinary Wassermann bath and kept at a temperature of 37° C.

Mixing by inverting the tubes is done as a routine measure three times during the first twenty minutes, unless signs of a positive reaction have already made themselves manifest.

At the end of one hour, six hours, eighteen hours and twenty-four hours, the results are read and recorded. Saline negative and positive controls are set up in similar fashion according to the method described above. 1 c.c. of normal saline replaces the 1 c.c. patient's serum in the saline control, while 0·4 c.c. of known negative and positive sera will be added respectively to the 1·6 c.c. normal saline in the first tubes of the series instead of 0·4 c.c. of patient's serum.

For the positive control is taken one-half of a serum previously

proved to be positive both by the Wassermann and Sachs-Georgi tests.

Reading of Results.

In well marked cases there is no difficulty, even for the most inexperienced, in reading both positive and negative reactions. The negative tubes show at the end of eighteen to twenty-four hours the same uniform shimmering fluid which on agitation presents the appearance of watered silk. The impression of the term 'watered silk' must be very carefully appreciated by the beginner, as upon that impression depends future success or failure in reading results.

The use of a hand-lens in doubtful cases is advocated and has proved of service to my assistants, but personally I have found the readings of 'granular positives' relatively simple, as my own visual acuity is − 5 D.

Positive results, if very marked, give the appearance of snow-flakes suspended throughout a clear fluid, and from the gradual settling of these white masses, a snowy layer ultimately forms at the bottom of the test-tube.

The supernatent fluid is then absolutely clear. The flocculations in this class are termed massive, and the precipitate heavy; we register it as XXX.

If defintely positive but less marked, the tubes give the appearance met with in ordinary bacterial agglutinations when a high titre serum is used.

The flocculi tend to deposit later and leave a clear supernatent fluid; this we regard as XX.

In the third group considerable difficulty may be experienced in differentiating the finely granular flocculi of a positive from the homogeneous suspension of the antigen. The appearance presented is somewhat like particles of dust shewn up by a ray of bright sunlight suddenly penetrating a dark room. There is little or no tendency for these particles to deposit, and the fluid does not become clear as in positives described above, this we record as X.

If doubt still exists, recourse may be made to having the tubes centrifuged to see whether a deposit can be obtained.

It has not been considered necessary to adopt any artificial lighting device to help in the reading of the results.

In passing, it may be remarked that on numerous occasions tubes

have shown what appeared to be positive reactions within the first few hours, but at the end of eighteen to twenty-four hours this appearance had completely disappeared; and also, it has been noted that gentle agitation may produce such a disappearance in what may be called pseudo-positives.

I shall have occasion later to refer to the occurrence of positive readings in the Sachs-Georgi reaction—actual positives which do not disappear as those mentioned in the last paragraph, but which owe their existence, although not to syphilis, to certain definite causes.

(*B*) ACTUAL RESULTS

1. *Complete* POSITIVE *agreement was obtained between the Wassermann and Sachs-Georgi reactions*:—

(*a*) In three hundred and ten *untreated* cases submitted from venereal clinics and hospitals with a definite history of syphilis.

Analysis of these three hundred and ten cases:—

(1) *Primary stage.* Forty cases.

(2) *Secondary stage.* Two hundred and fifty cases.

These cases without exception showed typical pictures of secondary syphilis-rash, sore throat, mucous patches, etc. They had neglected the primary stage completely, and had come to seek advice only when the rash, fever, and constitutional symptoms manifested themselves.

(3) *Tertiary stage.* Eight cases.

TABLE I.

Cases	History	Wassermann reaction	Sachs-Georgi reaction
4	Gummata	XXX	XX
1	General paralysis	XXX	XX
2	Cerebro-spinal fluids in cases showing nervous symptoms	XX	XX
1	Hemiplegia	XX	XX

(4) *Congenital syphilitics.* Five cases.

These were discovered during the routine examination of inmates of an orphanage.

(5) In seven cases where the patients had several abortions.

Table II.

Case	History	Wassermann reaction	Sachs-Georgi reaction
1	3 abortions; 2 still births	XXX	XXX
2	5 abortions	XXX	XX
3	6 abortions	XXX	XX
4	5 abortions	XXX	XX
5	2 abortions	XXX	XXX
6	'Several abortions'	XXX	XX
7	'Several abortions'	XXX	XX

In case No. 1, husband had syphilis five years ago, and was treated with full course of Neo-Salvarsan injections. Serum tested by both reactions on same day as patient gave completely negative readings.

(*b*) In certain *treated* cases.

Eight cases showed markedly positive reactions. Of these cases one had received two injections of Neo-Salvarsan, and four had had 'complete' treatment (see below).

(*c*) In ninety-seven cases where no history accompanied the specimens.

2. *Negative agreements.*

Negative readings in all tubes of both reactions were obtained in five hundred and fifty cases of sera submitted without definite history, and as part of routine examinations. In two cases previously reacting XXX to both tests, sera now are completely negative to both.

3. *Partial agreements.*

These may be best illustrated as follows:—

Table III.

Cases	Wassermann reaction	Sachs-Georgi reaction	Remarks
4	XXX	X	1 with 4 injections of Neo-Salvarsan.

4. *Non-agreement.*

(*a*) In forty-five cases submitted, mostly without history, the Wassermann reaction was definitely positive, the Sachs-Georgi negative. In thirteen cases, however, details were supplied-symptoms of primary stage 8, of secondary stage 5.

(*b*) In twenty-one cases the Sachs-Georgi reaction was positive, the Wassermann completely negative. This figure does not include positive Sachs-Georgi reactions obtained during experiments performed. These latter will be detailed below.

(*c*) In twenty-three treated cases, the Wassermann was positive, the Sachs-Georgi negative.

(These cases were either partially or completely treated according to the following routine method practised here.

The course of Neo-Salvarsan injections is:—

1st injection	...	0·45 grammes.
2nd injection	...	0·60 grammes one week later.
3rd injection	...	0·75 ,, ,, ,, ,,
4th injection	...	0·90 ,, ,, ,, ,,
5th injection	...	0·90 ,, ,, ,, ,,)

Table IV.

No. of cases	Wassermann reaction	Sachs-Georgi reaction	Remarks
14	XX	o	'partially' treated
2	XXX	o	'with 3 injections'
7	X	o	'complete treatment'

(C) THE RELATIVE PERCENTAGE OF AGREEMENT BETWEEN THE REACTIONS

The calculations are based upon one thousand and thirty-seven examinations of sera.

1. *Positive agreement.*

In all, four hundred and eighty-seven showed a well-marked positive Wassermann, while with the corresponding sera the Sachs-

Georgi reaction showed positive readings in four hundred and nineteen.

The positive agreement therefore is 86 per cent.

2. *Negative agreement.*

Whereas the Wassermann reaction was negative in five hundred and fifty cases, the Sachs-Georgi was negative in six hundred and eighteen.

The negative agreement is therefore 89 per cent.

(*D*) CERTAIN FALLACIES OF THE SACHS-GEORGI REACTION WITH CERTAIN EXPERIMENTS MADE WITH A VIEW TO EXPLAIN THE CAUSE OF SEVERAL, AND WITH CERTAIN THEORETICAL OBSERVATIONS

(1) The presence in the serum to be tested of contaminating organisms renders the findings of the Sachs-Georgi reaction of no value whatever.

The first disparities between the Wassermann and Sachs-Georgi reactions here occurred in cases where the sera were sent from a distance, and when two or three days elapsed between collection and examination.

In those cases, fortunately, little doubt could exist as to contamination, as the sera were turbid and malodorous on arrival. Actual proof was obtained by plating on culture medium. A new series of reactions was performed in the case of those sera proved contaminated: they were re-submitted, and after transmission, arrived in a sterile condition. On these occasions they showed a completely negative reading where previously they had shown a strongly positive reaction. I refer in this connection only to sera which reacted positively to the Sachs-Georgi when the Wassermann reaction remained negative.

Further proof was adduced by the following simple experiment:—

A normal blood was drawn off in the laboratory, and the serum proved negative by both reactions.

The serum was then artificially infected with (*a*) *B. typhosus* and (*b*) *B. subtilis*, and then after suitable incubation the sera were set up in the ordinary dilutions, with the following results:—

Table V.

Case		Wassermann reaction	Sachs-Georgi reaction	Remarks
1	Normal blood serum ...	o	o	—
2	The same serum infected with *B. subtilis*	o	XXX	In both cases flocculation massive, precipitation heavy.
3	The same serum infected with *B. typhosus*	o	XXX	

If, then, the reaction could be completely altered by the presence of contaminating organisms in the serum, I considered it advisable to test the sera of patients suffering from certain diseases, to determine whether positive results in the Sachs-Georgi might be obtained here also.

The results are of interest, and although unfortunately at present the number of such examinations is small, yet I hope later to submit the results of examinations of many sera collected from patients suffering from the diseases most common in Palestine, so as to determine to what extent the Sachs-Georgi reaction is influenced by such.

First I was able to obtain six sera from lepers in Jerusalem, and the particulars and reactions are as follows:—

Table VI.

Case		Treatment	Wassermann reaction	Sachs-Georgi reaction
1	Nodular leprosy ...	Injections with Ol. Chaulmoograe for 1½ years	o	o
2	Nodular leprosy ...	Injections with Ol. Chaulmoograe for 3 months	o	X
3	Nerve leprosy ...	Untreated	o	XX
4	Nerve leprosy ...	Untreated	o	o
5	Nodular leprosy (?)	Untreated	XXX	XXX
6	Nodular leprosy ...	Treated with Ol. Chaulmoograe ...	o	XXX

From these examinations, no conclusions can be made.

In addition, however, the following examinations were made all at the same time with the fullest possible controls. All precautions were taken to ensure (*a*) freedom of the sera from contamination, except where otherwise indicated; (*b*) that the reactions were made in the dilutions considered essential; (*c*) that the reaction of the normal saline used was PH7 ; (*d*) that the readings were made after one hour, six, eighteen, and twenty-four hours, and that pseudo-flocculation was eliminated.

As these examinations have been performed for experimental purposes, the results have not been included in the calculations made as regards positive and negative agreements.

Table VII.

No. of case	History	Wassermann reaction	Sachs-Georgi reaction	Remarks
1	Street case taken at random ...	o	o	
2	Negative control	o	o	
3	Positive control	XXX	XXX	
4	Hospital routine examination ...	o	o	
5	Routine examination from clinic ...	o	o	
6	Case of untreated syphilis (stage 2)	XXX	XXX	
7	Sore throat, rash, typical 2nd stage	XXX	o	Disparity 1
8	Aneurysm of Aorta	XXX	o	Disparity 2
9	Case of syphilis previously reacting strongly to both reactions, treated with 4 injections of Neo-Salvarsan	XXX	XXX	Treated according to table above.
10	Case of syphilis previously proved positive to both reactions—treated with 4 Neo-Salvarsan injections	XXX	XXX	
11	Sore throat, mucuous patches ...	XXX	XXX	
12	Soldier—contracted syphilis 1921—fully treated	o	o	
13	Soldier—Syphilis 1921—full course of treatment	o	o	
14	Soldier—primary case chancre ...	XXX	XXX	
15	Soldier—ulceration of palate ...	XXX	XXX	

TABLE VII—*Continued.*

No. of case	History	Wassermann reaction	Sachs-Georgi reaction	Remarks
16	Male—previous syphilis untreated	XXX	XXX	
17	Female—married case 16 last year; has had a child full term, showing signs of congenital syphilis ...	XXX	XXX	
18	Untreated secondary stage syphilis	XXX	XXX	
19	Arthritis (right ankle)	XXX	XX	
20	Syphilis—after full treatment ...	o	o	
21	Periostitis of femur	X	o	
22	Ulceration of buttock	o	o	Pseudo-flocculation in first tube only.
23	Routine examination—no history	o	o	
24	Routine examination—no history	o	o	
25	Routine examination—no history	o	o	
26	Routine examination—no history	o	o	
27	Pharyngitis	o	o	
28	Chronic Jaundice	o	o	
29	Tumour of R. hypochondrium independent of liver; inguinal glands enlarged; pigmentation of legs and ankles	o	XX	Disparity 3
30	General malaise	o	o	Pseudo-flocculation in 1 tube only.
31	Pustular eruption	o	o	Pseudo-flocculation in 1 tube only.
32	Enlarged spleen (malarial)	o	o	
33	No history	o	o	
34	No history	o	o	
35	General malaise	o	o	
36	Serum from case of Typhus fever showing all clinical symptoms and reacting to Weil-Felix test (*B. proteus* × 19) 1 in 400 ...	o	XXX	Disparity 4
37	Serum from case of Typhus fever Weil-Felix reaction 1 in 400 ...	o	XXX	Disparity 5
38	Serum from case of Typhus fever Weil-Felix reaction 1 in 200 ...	o	X	Disparity 6

TABLE VII—*Continued.*

No. of case	History	Wassermann reaction	Sachs-Georgi reaction	Remarks
39	Serum from case of Typhus fever Weil-Felix reaction 1 in 400 ...	XXX	o	Disparity 7
40	Serum from case of Relapsing fever	o	o	
41	Normal blood serum	o	o	
42	Serum of 41 infected with *B. typhosus*	o	XX	Disparity 8
43	Serum infected with *B. subtilis* ...	o	XX	Disparity 9
44	Serum of patient suffering from acute lobar pneumonia	o	XX	Disparity 10
45	Serum—another patient recovering from lobar pneumonia	o	XX	Disparity 11

In the case marked pseudo-flocculation in tube 1, it was found, as previously mentioned under 'reading of results,' that gentle shaking of the tubes in question produced an immediate disappearance of the seeming flocculi.

The importance of the two precautions—(*a*) always to shake the tubes gently before reading; (*b*) not to give definite reading until after the tubes have been set up for eighteen to twenty-four hours—cannot be too strongly emphasized.

I do not attempt to give any explanation of the disparities between the two reactions in the cases instanced above, but these few findings would seem to suggest that the presence of organisms, or products of organisms, in the patient's blood might well have some effect in reducing the value of the Sachs-Georgi unless the fullest history accompanies each serum submitted.

(2) Granted the complete sterility of the sera submitted, could any reason be advanced for the Sachs-Georgi reaction giving a strongly positive reading in the presence of a non-syphilitic serum?

From time to time in these laboratories the distilled water had been shown to be definitely acid, PH −, which acidity was due to various causes, principally carbon dioxide or absorption from an atmosphere containing acid fumes. Now it is a well-known fact that in agglutination tests, so-called 'pseudo-clumping' may occur on account of excessive acidity of the culture medium (see

Biggs & Park, American Journal of Medical Science, 1897; Block, B.M.J., 1897).

Agglutination of bacteria by acids in definite concentration can be carried out, and the phenomenon seems to depend upon the hydrogen ion concentration. In this connection the clumping of bacteria in acid agglutination is analogous to the clumping of colloidal suspensions of any kind, and the clumping or agglutination is merely a physical phenomenon, determined by the colloidal equilibrium of the bacteria in suspension. To digress a moment—this acid clumping was well exemplified by the experience of one of my assistants in Jaffa. He had been getting positive results in every Widal including controls performed in the laboratory there; and on enquiry being made it was discovered that the new laboratory attendant had rinsed the agglutination tubes after immersion in acid only perfunctorily. Reasoning that a similar or analogous phenomenon could occur in the performance of the Sachs-Georgi test, I had certain experiments carried out which seem to prove the likelihood of the supposition.

(*a*) Twelve sera were examined by the Wassermann and Sachs-Georgi tests. The diluent of antigen and serum was normal saline with a reaction of PH 7.

A third series was put up for the Sachs-Georgi test, but in this series the diluent of antigen and serum gave a reaction of PH 5.

The reading of the three series at the end of eighteen hours are as under:—

Table VIII.

No.	Wassermann reaction	Sachs-Georgi reaction (Normal saline used, PH. 7)	Sachs-Georgi reaction (Saline used, PH. 5)
1	XXX	XXX	XXX
2	XXX	XXX	XXX
3	o	o	XX
4	o	o	XX
5	o	o	o
6	o	o	X
7	XXX	XXX	XXX
8	o	o	X
9	o	o	X
10	X	X	X
11	o	o	o
12 control	o	o	XX

(*b*) In the next experiment serum was completely omitted and the Sachs-Georgi antigen prepared with saline diluents showing a PH reaction of 5, 6·6, 7, and 8·5.

Four tubes were arranged with contents as under:—

Tube 1 contained 0·5 c.c. antigen (diluent PH 5) and 1 c.c. saline (PH 5).

Tube 2 contained 0·5 c.c. antigen (PH 6·6) and 1 c.c. saline (PH 6·6).

Tube 3 contained 0·5 c.c. antigen (PH 7) and 1 c.c. saline (PH 7).

Tube 4 contained 0·5 c.c. antigen (PH 8·5) and 1 c.c. saline (PH 8·5).

These were placed in the water bath at 37° C., and read at the end of eighteen hours.

Tube 1 showed marked flocculation and precipitation, while tubes 2, 3 and 4 remained without change.

The PH reaction of the saline here is usually 6·6, and it is found that this reaction in no wise interferes with the performance of the test.

(3) A phenomenon which forced itself early on my notice was that whereas a well marked positive reaction might be obtained in dilutions of patient's serum 1 in 20 and 1 in 40, no reaction whatever was visible in the primary dilutions 1 in 5 and 1 in 10 when the readings were made at the end of one hour, six, eighteen, and twenty-four hours. The occurrence was relatively frequent and demanded some explanation.

Here again one was compelled to seek a parallel in the ordinary agglutinations in bacteriology. And an analogy certainly exists. It must have been the experience of every bacteriologist in the reading of results of ordinary routine agglutinations to note that when an organism is set up against increasing dilutions of patient's serum, it occasionally happens that the serum in low dilution or greater concentration fails to agglutinate the organism, while with the serum in higher dilution or less concentration marked agglutination occurs.

This phenomenon in bacteriology has been accounted for theoretically by the 'pro-agglutinoid zone,' and the terms 'zones of no reaction' and 'zones of inhibition' have been applied to those dilutions wherein agglutination fails.

Briefly the pro-agglutinoid theory consists in the belief that for various reasons (*e.g.*, length of time elapsing between the collection and examination of the blood), the agglutinins called forth by any specific agglutinogen may deteriorate or become converted into substances capable of uniting with the agglutinogens without, however, resultant agglutination.

These substances have stronger affinity for the agglutinogen than the agglutinins themselves, and are termed 'pro-agglutinoids.' If these substances, then, are present in large numbers in strongly reacting sera, they may wholly mask the reaction by preventing the actual combination of agglutinogen and agglutinin. If, on the other hand, the serum is less concentrated, then in proportion is the number of these substances so lessened that they cannot have any appreciable effect in preventing agglutinin from uniting with agglutinogen, and therefore the reaction is not obscured.

It is not, perhaps, logical to strain the similarity between the two phenomena too far when it is to be remembered that the Sachs-Georgi reaction is not even a specific antigen-antibody one, the antigen being a homogeneous suspension of lipoidal substances, and the antibody (which bears probably no relation to true antibody), a lipotrophic substance in syphilitic serum.

Similar phenomena, however, have been observed with non-specific agglutinating agents, and also in the action of coagulating agents on colloid emulsions.

Orthophosphoric acid, for example, will agglutinate a certain volume of a suspension of *B. coli* when present to the extent of between 118 cgrm. and 4 cgrm., and between 1·1 mgrm. and 0·001 mgrm., but not in intermediate amounts between 40 and 1·1 mgrm. (Hewlett).

Again, certain chemical substances have the power to agglutinate organisms, although their action is in no way specific, and the same substances will agglutinate different organisms (Beco). A mixture of equal parts of commercial formalin, alcohol, hydrogen peroxide, a 1 in 1,000 solution of chrysoidin, vesuvin, safranin, or perchloride of mercury, agglutinates the typhoid bacillus as well as other organisms. Whether, then, the phenomenon of zones of inhibition in the Sachs-Georgi reaction is determined by physical, chemical or other changes in the serum is not yet understood, but the analogy

between this and the phenomena occurring in ordinary routine agglutinations is at least very striking.

It is obvious, then, that if reliance were to be placed on the readings of the lower dilutions, or that if lower dilutions only (*e.g.*, 1 in 5 and 1 in 10) were to be put up, the results would be untrustworthy.

(*E*) CONCLUSIONS AND INFERENCES

1. The Sachs-Georgi cannot take the place of the Wassermann reaction, and should not be employed alone unless it is impossible to obtain the reagents necessary for the performance of the Wassermann.

2. The advantages claimed for the Sachs-Georgi reaction are:—

(*a*) Negligible cost of reagents and necessities.

(*b*) Simplicity of technique.

(*c*) The rapidity with which strongly reacting positive sera can be read.

3. The Sachs-Georgi, from its percentage of agreement with the Wassermann Reaction (86-89), has a quite definite value, and if strict attention be paid by laboratory workers to the following points—fallacies (which constitute the main disadvantages of the reaction) may be largely obviated, and the Sachs-Georgi may be considered at least a useful aid in the diagnosis of syphilis:—

(*a*) The patient's serum must be as fresh as possible and free from organismal contamination. If doubt exists as to sterility, cultural tests should be applied. (In this laboratory it has become routine practice to inoculate culture media tubes during the time the reactions are being performed, from all cases where the sera have been submitted from a distance and which might be likely to be contaminated. If growth occurs, the result is discarded.)

(*b*) No opinion should be given on the results of this reaction unless a detailed history of the case accompanies the serum—this with a view to exclude the co-existence of other diseases. The presence of organisms, or their

products, in the patient's blood may completely negative the value of the reaction. In cases where a patient is suffering from an acute infectious fever, the reaction should not be employed.

(*c*) The saline diluent of antigen and patient's serum must be freshly prepared, and its reaction very carefully estimated. Its reaction to PH should be 7, and a variation of not more than 6·6 to 7 allowed.

(*d*) Not less than 3 (preferably 4) dilutions of patient's serum should be put up in each series, the last tube of the series showing a dilution of not less than 1 in 40—this to obviate the fallacy dependant on the 'zones of no-reaction.'

(*e*) Final opinions should not be given until eighteen to twenty-four hours have elapsed from the time the reaction has been performed. Pseudo-flocculation, which may occur during the first few hours, tends to disappear before the end of twenty-four hours and, if still present, can be dispelled by gentle agitation of the tubes.

4. The treated cases which have been controlled throughout the full course tend to show that the Wassermann reaction remains positive longer than the Sachs-Georgi. A negative Sachs-Georgi reaction, then, in treated cases would not form a reliable index as to cure of the patient.

5. The Sachs-Georgi reaction remains negative in certain definitely established cases of syphilis, and this for no apparent reason. It is justifiable, therefore, perhaps to conclude that a negative Sachs-Georgi reaction is of little or no value.

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